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Improving rehabilitation treatment in a local setting: a case study of prosthetic rehabilitation

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Objective: To contribute to the discussion on the research–practice gap by illustrating obstacles and opportunities that arise in an evidence-informed improvement process of prosthetic rehabilitation in a local setting.

Setting: Dutch rehabilitation centre.

Presupposition: The improvement process was considered as a two-way translation process rather than a unidirectional process of knowledge transfer between science and practice.

Method: Case study and participatory research methods comprising documentary analysis, treatment observations, individual and focus groups interviews, and literature studies. A qualitative software program (Atlas-ti) was used to triangulate the collected data.

Results: The main concern of local practitioners was identified to be the post-discharge decline in functional capacity in elderly amputees. This was related to a predominantly biomedical and biomechanical approach, and accompanying traditional therapist–patient interactions. The content and underpinnings of prosthetic treatments were scarcely specified in either the scientific literature or the local setting. Generic principles and practices from other fields were useful for treatment innovation for post-discharge problems, such as task- and context-specific training and self-management education. A circuit training focused on motor learning and a problem-solving training focused on social learning were developed by integrating amputation-specific knowledge.

Conclusion: Improving rehabilitation practice with the use of available evidence is a heterogeneous and multifaceted scientific enterprise. Such an enterprise requires as much self-reflexivity from researchers as from practitioners.

Introduction

Clinical research should be aimed at improving treatments delivered rather than at just proving

their effectiveness.¹ It is commonly accepted that improvements in clinical practice have to be based on available evidence. Most research findings are, however, not ready-made for straightforward application in clinical practice.^{2,3} For instance, the population of subjects used in research may differ markedly from the clinical population to which the results are to be applied. Besides, it is very difficult to synthesize the body of evidence available into a coherent piece of advice on how

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to manage a particular situation.⁴ What is more, such an advice needs to be incorporated into an existing practice. Indeed, a practitioner is far from empty with respect to knowledge, concerns, demands on time and resources, and other contextual considerations.² The question then is how to bridge the gap between general research results and a local clinical practice.

Usual solutions for this research–practice gap tend to investigate ways to communicate available evidence to practitioners as an intervention to overcome barriers to change in clinical practice.^{2,5} Quality improvement interventions, for instance, try to enhance the uptake of evidence-based guidelines by creating a dialogue between researchers, content experts, front line staff members and managers.^{3,6,7} Advocates of so-called practice-based research on the other hand attempt to include practitioners at the very beginning in the research process.^{8,2} Another remedy is found in bringing researchers into action as knowledge translators between research and practice. Improvement of clinical practice is thereby not regarded as a linear, unidirectional process of knowledge transfer, but as an iterative and interactive process focused on actively translating evidence into usable interventions for local settings.⁹

This paper presents a case study in which the obstacles and opportunities of an iterative and interactive translation process are illustrated with the example of a rehabilitation treatment for patients with a lower limb amputation in a Dutch rehabilitation centre. We not only took up the challenge of translating scientific knowledge into a usable form relevant for this local practice, but also added an extra element. Inspired by recent ethnographical work^{1,10,11} we chose first to explore the implicit knowledge, concerns and lacunas of practitioners in the local setting under study, and then searched for relevant knowledge in the scientific literature that could be useful in improving their rehabilitation treatment. The aim of this case study is twofold: (1) to provide details of a concrete, evidence-informed improvement process of prosthetic rehabilitation, and (2) to enrich the more abstract discussion on the research–practice gap.

Method

A combination of case study and participatory research methodology was used comprising documentary study, treatment observations, individual and focus group interviews with practitioners and patients, and literature study. The collected knowledge was analysed with help of the qualitative software program Atlas-ti (www.atlasti.com). Atlas-ti is valuable for triangulation. It assists in extracting, coding and comparing meaningful fragments out of the texts, transcribed interviews and noted observations. Information from one data source can thereby supplement, refine or provide background information for other data sources.

The local setting under study was a Dutch rehabilitation centre to which patients with disabling conditions due to acute and chronic conditions are admitted for multidisciplinary rehabilitation treatment. The case study was focused on the amputee team consisting of physiatrists, physiotherapists, occupational therapists, nurses, a prosthetist, a psychologist and a social worker.

The study started with a request from the multidisciplinary team to update their treatment programme. The resulting improvement process consisted of an iterative and interactive approach between the team and the first author. The first author (SvT) took the role of participatory researcher and knowledge translator. The last author (AL) acted as an outsider by critically reflecting on the steps in the improvement process. Each step followed from the results of the step before and thus served a different purpose.

The first improvement step was aimed at specifying the explicit and implicit knowledge of the multidisciplinary team under study by focusing on the content and conceptual underpinnings of their prosthetic rehabilitation treatment. All the written material that the team had produced to explain their treatment to other stakeholders was analysed, including a description of the rehabilitation programme, a patient leaflet and two chapters from a Dutch textbook in which physiotherapists and occupational therapists clarified their part of the treatment.¹² Subsequently treatment observations and semi-structured interviews with team members were employed to elucidate the written

material and to identify gaps in their treatment descriptions.

The second step consisted of a search into the scientific literature on prosthetic rehabilitation in order to find evidence and new scientific insights that could be used to improve the prosthetic treatment under study. No attempt was made to perform a full systematic review. As the aim was improvement of the content and conceptual underpinnings of the local treatment, the focus of attention was more on treatment research than on dysfunction research.^{13,14} Dysfunction theory conceptualizes how a particular problem comes about – for instance, phantom pain or a motor problem – how it is maintained, how it ends or reappears and so on. Treatment theory refers to the conceptual underpinnings of the process of change during treatment; the assumed working mechanism of prosthetic training.

In a third step a wider search into rehabilitation literature was conducted to seek promising generic rehabilitation principles and practices that might resolve the critical issues at stake in the local treatment under study.

The focus of the fourth step was on gathering amputation-specific knowledge in order to translate the generic principles and practices to prosthetic rehabilitation treatment. Individual and focus group interviews were held to obtain data about patient's needs on the one hand and to collect knowledge of practitioners on patient's motor problems on the other hand.

In the fifth step the generic principles and practices were translated into two treatment modules for the local prosthetic rehabilitation programme. An overview of these steps is presented in a flow diagram in Figure 1.

Request from the team

The request from the amputee team to update their treatment programme was primarily based on the concern that the skills learned in the clinical setting were not preserved after discharge from the rehabilitation centre. All team members worried about the decline in functional outcome experienced especially by the

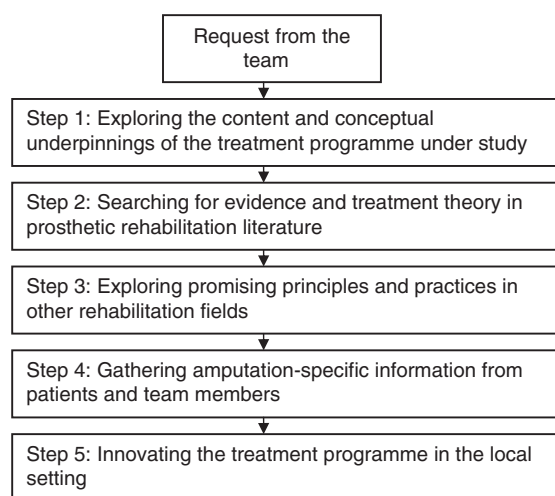


Figure 1 Iterative and interactive translation process.

elderly lower limb amputee. Take the following interview quote:

I'm not really worried about the younger patient with a lower limb amputation; he or she will probably be inclined to move. My worries concern the elderly amputation patient based on vascular problems. He or she will not be able to walk long distances in bad weather; won't do any shopping. The level of his/her condition will therefore slowly decline after discharge and he/she starts functioning worse.

Step 1: Exploring the treatment content and its conceptual underpinnings

With this carry-over problem in mind we started to explore the content and conceptual underpinnings of the prosthetic treatment in the local setting.

Documentary study

The documentary study provided information on the programme's content in terms of *which* discipline had to do *what* part of the treatment. The treatment protocol, for example, stated that physiotherapists were responsible for prosthetic gait training and sport activities, whereas occupational therapists had to train patients to use a wheelchair

or to perform activities of daily living with a prosthesis. But the documents hardly gave any information on *how* therapists delivered their part of the treatment, and *why* they choose to do so in that specific manner. The content and conceptual underpinnings of the treatment could thus not be specified sufficiently with the help of the team's manuscripts.

Semi-structured interviews

The team members were therefore asked to address the 'how' and 'why' questions in semi-structured interviews. They depicted their treatment in terms of treatment goals such as reducing oedema of the stump, preventing contractures and skin defects, optimizing strength and general condition, providing optimal prosthetic prescription or balance and mobility training in functions of daily living. However, they still had difficulties in explaining *how* they attempted to produce therapeutic change, and *why* it was supposed to work. Take the following quotes:

What the treatment is based on? No, I can't answer that question right now.

and

It is hard to articulate. Normally you don't dwell on that.

Analysis of interview transcriptions

Analysis of the transcribed interview material revealed that the underpinnings of prosthetic treatment were presumably biomedical and biomechanical of character. Implicitly, therapists referred to principles of exercise physiology and physical training when talking about strength and condition training:

When the patient has set his goal on unlimited walking indoors and walking small distances outdoors, as a physiotherapist you translate this goal to an optimal condition of the stump, sufficient mobility, adequate muscle force, optimal balance and enough condition to achieve this goal.

In addition, they used biomechanical terms when prosthetic training was the topic of conversation:

With respect to prosthetic training I especially think about the technical aspects of dealing with a particular type of prosthesis. An amputee patient with a knee ex-articulation, for instance, does have more possibilities to use his hip musculature in an adequate and efficient manner than a patient with a transfemoral amputation. ... It is also quite a difference when you train somebody with a free swinging knee or locked prosthetic knee joint. The first needs far more time to learn to control the knee mechanism before starting gait training.

Treatment observations

We got more insight into *how* content was given to prosthetic rehabilitation by watching various treatments, thereby focusing on the delivery form, instructions, exercises and the context of the treatment. Noticeable in these observations was that predominantly elderly patients relied heavily on the knowledge and expertise of the therapists. Most therapists thereby did little to encourage patients to be active learners. Often the therapist had the role of the expert: they prescribed patients how to deal with problems in ambulation. Instead of teaching patients actively how to perform their daily tasks with a prosthesis, patients were approached as more passive recipients of therapeutic intervention.

Synthesizing data with the help of Atlas-ti

By integrating the data from the different method sources with Atlas-ti, we not only indicated a critical issue in the knowledge and skills of the team but also a possible way out. Namely, the team's concern – the patients' decline in functional capacity after discharge – could be related to the traditional roles of the therapists and patients. This traditional interaction between therapist and amputee seemed to be indirectly derived from a treatment programme primarily based on biomedical and biomechanical principles in which therapists are the technical, and

therefore, training experts and patients have to be compliant. The application of more up-to-date learning theories in which patients actively participate in prosthetic training could be a solution to this carry-over problem.

Step 2: Searching for evidence and treatment theory in prosthetic rehabilitation literature

We searched in the scientific literature on prosthetic rehabilitation for evidence and conceptual underpinnings that supported or refuted our solution.

An overwhelming volume of articles on dysfunction research

An overwhelming volume of articles on a great variety of topics emerged when we searched the database PubMed for terms such as '(lower limb) amputation', '(prosthetic) rehabilitation', '(lower limb) amputees', and combined that search with terms such as 'treatment' and 'theory'. This urged us to delineate our search dramatically. A main focus on reviews appeared to be helpful. Most reviews, however, summarized research findings that could be labelled as dysfunction research. They focused on topics related to the onset, incidence, nature, maintenance or reappearance of problems patients with a lower limb amputation are confronted with such as phantom pain,¹⁵ gait analysis,¹⁶ amputation surgery,^{17,18} physical capacity and walking ability,¹⁹ sexuality and amputation,^{20,21} and skin problems.²² Most reviews concluded that the available evidence had implications for clinical practice but few concrete suggestions on how research results could be used for treatment innovation were offered. Above all, these topics were not relevant for our improvement question.

Little evidence available in scarce articles on treatment research

Literature about treatment research appeared to be scarcer. In a 10-year review of rehabilitation prosthetics literature (1990–2000) it was concluded that no articles were found with new aspects regarding para-medical treatment.²³ Another review suggested that an interdisciplinary team

approach with active participation of the patient should be implemented early in the pre-amputation period, as it might facilitate short hospital stay and earlier return to productivity with associated cost savings.²⁴ But *how* the amputee team should give content to active participation of patients and *which* learning principles should be applied, was not made explicit.

Most reviews summarizing treatment research focused particularly on the technical advances of prosthetics.^{25–30} We found one Cochrane review synthesizing the effectiveness of prosthetic rehabilitation for older dysvascular people following a unilateral transfemoral amputation.³¹ As just one clinical trial satisfied the methodological criteria, it was concluded that there was inadequate evidence to inform the choice of prosthetic rehabilitation, including the optimum weight of the prosthesis. Furthermore we detected one elegant clinical perspective study that entered in length into the biomechanical principles and practices of a new treatment called 'OrthoTherapy', a name selected by the author to define comprehensive biomechanical treatment that integrates physical therapy and prosthetic and orthotic technology.³²

Step 3: Exploring promising principles and practices in other rehabilitation fields

As the content and underpinnings of prosthetic rehabilitation were insufficiently described and there was little evidence available to inform treatment choice, we conducted a wider search into the literature to find interventions that encouraged active participation of patients in the rehabilitation process. We chose for two interventions – task- and context-specific training^{33,34} and self-management education,³⁵ as their content and conceptual underpinnings were analysed in a thorough way.^{36,37}

Task- and context specific training

There is evidence that task- and context specific training is successful in stroke rehabilitation.^{38,39} In addition, elderly patients may benefit from such training as it showed promising results compared to a resistance exercise programme.³⁴ The content analysis revealed that task- and context-specific training is informed by a mixture of

biomechanical, cognitive, motor learning and muscle physiological principles.³⁶ Biomechanical analyses of functional tasks by healthy subjects – such as sit-to-stand and walking – were used as a standard for identifying essential components that are missing when individuals with stroke-induced hemiplegia executed such tasks.⁴⁰ The early stage of motor relearning is thereby cognitive of character. It requires verbal cues and feedback, visual input and explanations concerning missing/essential components which may help patients to think things through.⁴¹ So, task- and context-specific training appealed to patients' problem-solving capacities rather than relying on practitioners' prescriptions.

Self-management education

There is some evidence that self-management education can improve the health status of a heterogeneous group of chronic disease patients while reducing hospitalization.⁴² Self-management also makes a strong appeal to patients' problem-solving capacities.³⁵

Four basic problem-solving skills are taught: (1) problem definition and formulation, (2) generation of alternative solutions, (3) decision making and (4) solution implementation and verification.⁴³ Self-management education is aimed at enhancing the patients' self-efficacy through interventions such as mastering of skills, modelling, interpretation of symptoms and social persuasion.³⁵ Self-efficacy is derived from social cognitive learning theory and is defined as the belief in one's capabilities to organize and execute the courses of action required to produce given attainments.⁴⁴

Contrasting task- and context-specific training and self-management education

So both task- and context-specific training and self-management education focused on active participation of patients in the rehabilitation process in order to enhance the transition from the clinical to the home setting. In task- and context-specific training, however, patients' problem-solving capacities were deployed to teach them the necessary motor skills after a stroke with an acute onset,³⁶ whereas in self-management education such

capacities were appealed to in order to provide patients with the *psychological* skills to deal with the unpredictable course of a chronic illness.³⁷ We argued that both skills could be valuable in assisting patients with a lower limb amputation to cope more confidently with the carry-over problem.

Step 4: Gathering amputation-specific information

To be able to translate the promising principles and practices in concrete interventions relevant for elderly amputees we needed amputation-specific information to: (1) specify essential components of motor tasks in prosthetic training; (2) identify post-discharge problems of amputees.

Focus group discussion on essential components of motor tasks

In a focus group physiotherapists were invited to discuss prosthetic training in terms of missing and essential components. Several motor tasks such as walking, sit-to-stand, getting up from the floor, picking up an object and crossing obstacles were specified into essential components in functioning with a prosthesis. According to the therapists such components had in particular to do with that part of the movement pattern where the patient needed to place weight on their prosthesis or had to cope with the working mechanism and restrictions of the prosthetic knee and foot. For example, patients with an above-knee amputation needed to shift weight on their forefoot to unlock the knee before sitting down. And the restrictive mobility of a prosthetic ankle needed to be dealt with when stepping down from a stair or in kneeling down.

Individual and focus group interview on post-discharge problems

Individual interviews with therapists from several disciplines provided information about post-discharge problems such as lack of space or rough carpet in the home setting compared with the large ceiled rooms and extended passages in the rehabilitation setting, influence of the weather on outside activities and shortage of attention for stump wounds. In a patient focus group interview

the transition from the rehabilitation centre to their home was recounted in terms of

'I have a feeling of doing nothing at all'

or

'You have to be aware of falling into a sort of limbo; it is quite a transition'.

Patients clarified their feelings as a loss of supervision, not receiving encouragement of peers anymore and lack of therapy structure. Examples of problems they had to face at home were provided such as getting downstairs with a laundry basket or preparing dinner in a poorly adapted kitchen.

Step 5: Innovating the treatment programme in the local setting

With the help of this domain-specific knowledge two new group modules were developed: (1) a circuit training in which patients actively learn to deal with the essential components in functioning with a prosthesis, and (2) a problem-solving training in which patients actively learn to cope with post-discharge problems.

Circuit training

The circuit training consists of several working stations in which therapists have to create a challenging motor learning environment. The missing components that are relevant for patients with a lower limb amputation are trained at these stations, varying from basic motor skills such as walking and getting up from a chair to more advanced activities such as getting up from the floor or crossing obstacles. Verbal instructions on the essential components of the task are presented on the wall combined with visual cues on the floor, so patients know exactly what to do and how to monitor their own performances. Instructions and feedback are provided by therapists in a manner that stimulates mental practice of the patient and offers patients options to critical reflect upon their own performances. In addition, patients have to form couples so one patient can monitor the results of the performances of the other and register the progress graphically. The same skill is also trained within a working station in different contexts, for example sit-to-stand from chairs of different heights.

Problem-solving training

In the problem-solving training the four basic problem-solving skills are taught and applied to two main amputation-related items: mobility and limb care. Each item encompasses several subitems. Mobility, for instance, is related to contextual constraints such as differences in material environment between the home and the rehabilitation setting, the impact of the weather, the loss of supervision of the therapist, encouragement of peers and lack of therapy structure. Limb care is divided into subitems such as stump care, hygienic actions, dressing, wound management and stump volume changes. The required knowledge on these items is presented and discussed in interactive classes. Patients not only get the opportunity to practise skills such as stump dressing with each other, they are also invited to bring in real life scenarios with respect to experienced problems. Each session ends with the construction of an individual action plan on how to act on a chosen aspect of the discussed item during the days at the rehabilitation centre as well as during weekend leaves. The action plans are evaluated in the next group session.

Discussion

The challenges of translating research evidence into a usable form that is relevant to local practice are rarely discussed.⁹ Most solutions for the research-practice gap are mainly discussed in terms of research dissemination and utilization, thereby explaining difficulties in uptake of evidence and related clinical guidelines in terms of resistance of practitioners.^{2,5} In this case study on prosthetic rehabilitation we started our explorative research with another set of orienting presuppositions of which the theoretical and practical implications will be touched on in this discussion section. In doing so, we hope to enrich the discussion on the research-practice gap in rehabilitation.

Presuppositions regarding the research-practice gap

Inspired by sociologically informed conceptions of science we regarded clinical research and clinical practice as two complex knowledge practices,

the appropriateness of which is open for further analysis and comparison.^{1,11,36} Accordingly the evidence-informed improvement process was considered as a two-way translation process between clinical and scientific knowledge practices rather than as a unidirectional process of knowledge transfer from the heights of science to a local clinical setting. This implied that researchers should not just act as evidence producers, summarizers, disseminators or resistance removers, but also take the role of knowledge translators and reflective questioners.

We did not know, however, at least not in a strong sense, how – within these presuppositions – our knowledge translation and reflection efforts would work out in practice. Nevertheless it led us to gather different kind of material including treatment descriptions, transcriptions of interviews, field notes as well as scientific literature. By analysing and comparing the clinical and scientific material – and raking through what had been written, told and noticed – we generated a sense of pattern, and with that, made a series of ‘decisions’ about what (or what not) counted as warrantable translations within this local setting. Although the decisions and collected data are above all pertinent to the local setting under study – and therefore can be questioned for generalization to prosthetic rehabilitation in other settings – the strategies used can be challenging and inspiring for all researchers and practitioners who want to collaboratively work on the improvement of rehabilitation treatments.

Challenges for local practices

Most of the knowledge in the local practice as well as the scientific literature on prosthetic rehabilitation appeared to be predominantly biomedical and biomechanical of character. It was also noticeable that both insufficiently described how prosthetic rehabilitation produced therapeutic change, and why it was supposed to work. However, by limiting our scope on scientific literature, we may possibly have neglected a body of potential useful information on prosthetic rehabilitation such as that in text books. By identifying the main concern of the local practitioners as a post-discharge decline in functional capacity of

elderly amputees, we could focus our search on promising principles and practices in other rehabilitation fields to address the functional carry-over problem, such as task- and context-specific training and self-management education. With help of amputation-specific knowledge the more generic principles and practices could be translated in two novel prosthetic rehabilitation modules: a circuit training focused on motor learning and a problem-solving training focused on social learning. The identified knowledge lacunas, concern and opportunities in prosthetic rehabilitation of this particular local setting may be recognizable, and therefore also challenging for other settings.

We do realize that this iterative and interactive translation process has been just a first step in the improvement process. Several other steps need to be taken. Our next challenge is to integrate and implement the treatment modules in the local setting. Thereby we can take advantage from the ethnographical material of the local setting by addressing the question which of the existing interventions are still critical, and which might be superfluous when integrating the new modules. As the novel modules try to tackle the main concern experienced by the local practitioners, they are sincere and driven to implement the novel modules. Indeed, it is important that practitioners feel the need for change. This may be a better guarantee for actual change than regulating it by external rules or applying generic guidelines.¹⁰ The last and future challenge is to design an effectiveness study that can examine the supposed superior value of the novel modules in an appropriate way. We have already started an explorative cohort study to examine and objectify the perceived decline in functional capacity after discharge from the rehabilitation centre.

Conclusions

This case study on prosthetic rehabilitation in a Dutch rehabilitation centre demonstrated that the nature of the questions that arise when attempting to use evidence for improvement of a rehabilitation treatment in a local setting are far more complex than assumed in unidirectional

knowledge transfer conceptualizations. It shows that improving rehabilitation practice with the use of available evidence is a heterogeneous and multifaceted scientific enterprise. It suggests that rather than trying to strengthen rehabilitation treatments by subjecting them to evidence-based rules, improvement strategies can be more successful when the clinical knowledge in the local setting is also seriously dealt with. Improving rehabilitation practice thus requires as much self-reflexivity from researchers as from practitioners. Only then can researchers and practitioners make optimal use of each other strengths.

Clinical messages

- Improving rehabilitation practice will be more promising when evidence-based as well as clinical knowledge is analysed and compared.
- Self-management and task- and context-specific training principles can be integrated in prosthetic rehabilitation to enhance the functional carry-over from the clinical to the home setting.

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Competing interests

None declared.

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